

Food Access in Delaware:

Examining the Relationship of SNAP Retailers, Food Deserts, Obesity, and Food Insecurity

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Introduction

Background

This study explores relationships between obesity, food insecurity, food deserts, Supplemental Nutrition Assistance Program (SNAP) participation, and SNAP retail locations among Delaware residents. By identifying areas of high need based on the co-occurrence of variables indicating poor food access, this study can inform service providers and policymakers who work to address food insecurity in the state. This study used geographic information systems (GIS) to examine the presence of the above variables at the county- and census tract-levels in Delaware.

Overweight and Obesity

Body Mass Index (BMI) a measure of body fat based on height and weight, allows a person to be categorized as underweight, normal, overweight, or obese. Individuals are considered overweight with a BMI between 25.0 and 29.9 and obese with a BMI of 30 or higher, placing them at high risk for chronic diseases such as diabetes, cardiovascular disease, and many others.¹ The proportion of overweight adults is increasing in all 50 states and is projected to reach higher than 50% for both adult men and women by 2030.² Delaware's adult obesity rate is 31.8%, lower than the national obesity rate (39.8%). When broken down by race, Blacks have the highest obesity rate (37.4%), followed by Latinos (31.9%), and non-Hispanic Whites (29.7%).³

Food Insecurity

Food insecurity can be defined as low food security (reduced quality or variety of diet) or very low security (multiple indications of disrupted eating patterns and food intake).⁴ According to Pruitt, people who are food insecure are at risk for obesity, hypertension, diabetes, and limited access to health care.⁵ In Delaware, 12.9% of residents are food insecure, and 5.1% experience

very low food security.⁴ The Food Bank of Delaware reports that 1 in 8 adults and 1 in 6 children struggle with hunger.

Supplemental Nutrition Assistance Program (SNAP) and SNAP Retail Locations

The United States Department of Agriculture (USDA) administers SNAP, the nation's leading anti-hunger program. SNAP provides supplemental nutrition support to individuals and families whose gross incomes are up to 130% of the federal poverty line, feeding over 44 million Americans in 2017.⁶ SNAP assists more than 42 million people each year, serving at-risk households with children, elderly or those with disabilities.⁶ Nearly all SNAP-eligible recipients participate in SNAP, and it is a crucial element to preventing food insecurity in populations in need of support.⁷ In 2017, 15% of Delawareans received SNAP benefits.⁸

Food Deserts

Food deserts pose barriers to affordable and nutritious food, particularly in lower-income communities. As defined by the United States Department of Agriculture (USDA), food deserts are areas devoid of fresh fruit, vegetables, and other healthful whole foods, usually in impoverished communities that lack grocery stores, farmers' markets, and/or healthy food providers.⁹ The common indicators to measure food access and food deserts are accessibility of sources to healthy food, individual resources such as income or vehicle availability, and neighborhood resources such as average income of a neighborhood and availability of public transportation.¹⁰

A census tract is considered low access if at least 500 people or 33% of the population in the tract are at least one mile from a supermarket or large grocery store (or ten miles if the tract is in a rural area).¹⁰ An estimated 17.7% of the U.S. population live in census tracts that are low-income and low access and are more than ½ mile (urban) or 10 miles (rural) from the nearest supermarket.⁹ According to a report by the University of Delaware's Institute for Public Administration, 61% of Delawareans live in census tracts with no grocery store, and 27% live in census tracts with only one grocery store.¹¹

Study Aim and Hypotheses

This study examines the geographic variables of SNAP retail locations, food deserts, rates of food insecurity and obesity in order to identify areas in which inequalities in food access may diminish the health benefits of SNAP. Although SNAP is successful when serving populations faced with food insecurity; healthy food may remain out of reach for SNAP recipients who live in food deserts, which may result in higher rates of overweight and obesity for those recipients. We hypothesize that food deserts and higher rates of food insecurity and overweight will exist predominantly in areas with fewer SNAP retail locations. Given that SNAP serves low-income individuals and families, it is important to consider the disparities of access to healthy food choices, and the potential benefits of increasing SNAP retail locations.

Methods

Data Sources

TIGER/LINE shapefiles depicting Delaware census tracts and counties were obtained from the U.S Census Bureau¹² and projected using the Delaware State Plane (NAD 1983 State Plane

Delaware FIPS 0700 (Meters)) coordinate system (U.S. Census Bureau, 2018). PolicyMap, a repository of spatial data, was used to obtain the following variables: prevalence of overweight (BMI 24.9-29.9) adults in Delaware by Delaware census tract; food insecurity rates by county¹³; percentage of SNAP recipients by census tract¹⁴; food deserts defined using the USDA's low-income and low-access measures⁹; and Delaware SNAP retail locations.¹⁵

Mapping and Analysis

ArcGIS (version # 10.3) was used for all mapping and analysis. Area-level data (food deserts and prevalence of overweight, food insecurity, and SNAP participation) were joined to Delaware census tract or county shapefiles using their respective Federal Information Processing Standards (FIPS) codes, a set of standardized geographic identifiers used by the U.S. Census Bureau. The attribute tables of the resulting new shapefiles were cleaned to remove unnecessary variables. The area-level variables of interest were depicted using choropleth maps, in which numeric values for polygons (e.g., prevalence of overweight, etc.) were symbolized using color ramps. Classification method and number of classes were used to symbolize each variable with natural breaks, quantiles, etc.

The point locations of SNAP retail locations were geocoded using a reference dataset of Delaware street addresses obtained from the U.S. Department of Agriculture.¹⁵ Unmatched addresses were compared to similarly named streets in Delaware and matched if the primary street name and ZIP code corresponded to a physical address; for example, a location on "College Street" that matched the ZIP code for the same numbered address on "College Road" was considered a match, with an achieved match rate of 97%. These geocoded locations were joined by spatial location to shapefile of census tracts, creating a sum of SNAP locations that fall within each census tract. The sum of SNAP locations per census tract was symbolized as a proportional dot map with differently sized dots corresponding to 0, 1, 2-5, 6-10, or 11-21 SNAP retail locations existing within the census tract.

Results

Figure 1 shows the proportion of adults reporting to be overweight in census tracts in Delaware using the CDC BRFSS 2009-2013 Census American Community Survey. The map clearly shows that the prevalence of adult self-reported overweight is highest in Northern Delaware and Southwest Delaware.

Figure 1: Percent of Adults Reporting to be Overweight (BMI 25.0 to <30) by census tract in Delaware in (2009-2013).

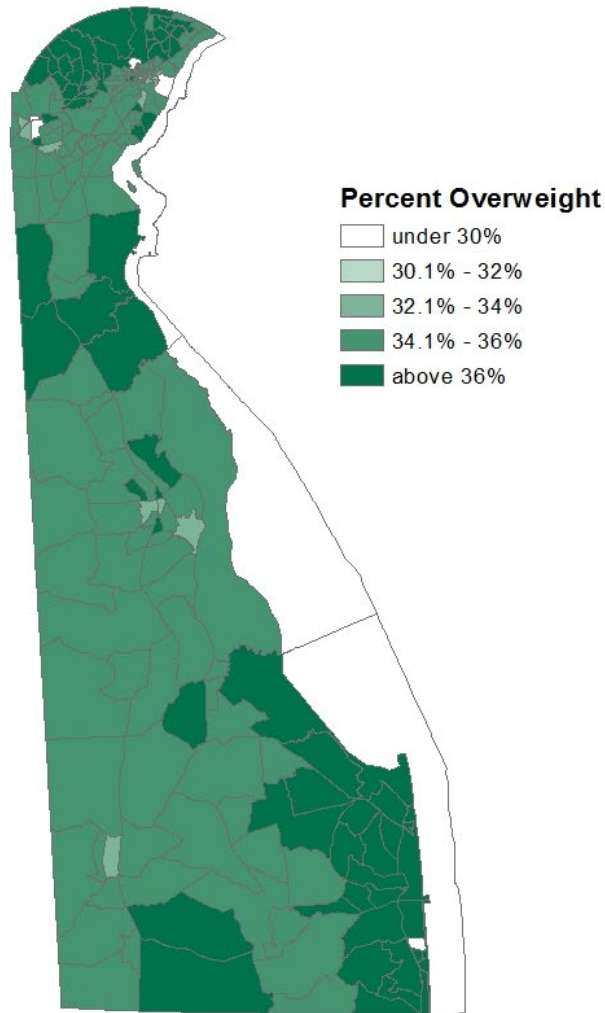


Figure 2 shows food desert locations, and when compared to Figure 1, the prevalence of overweight adults and food desert locations are closely related. Higher prevalence rates of overweight adults are located around low-income areas with little access to food (USDA ERS Food Access Research Atlas).

Figure 2: Location of Food Deserts in Delaware (2015)

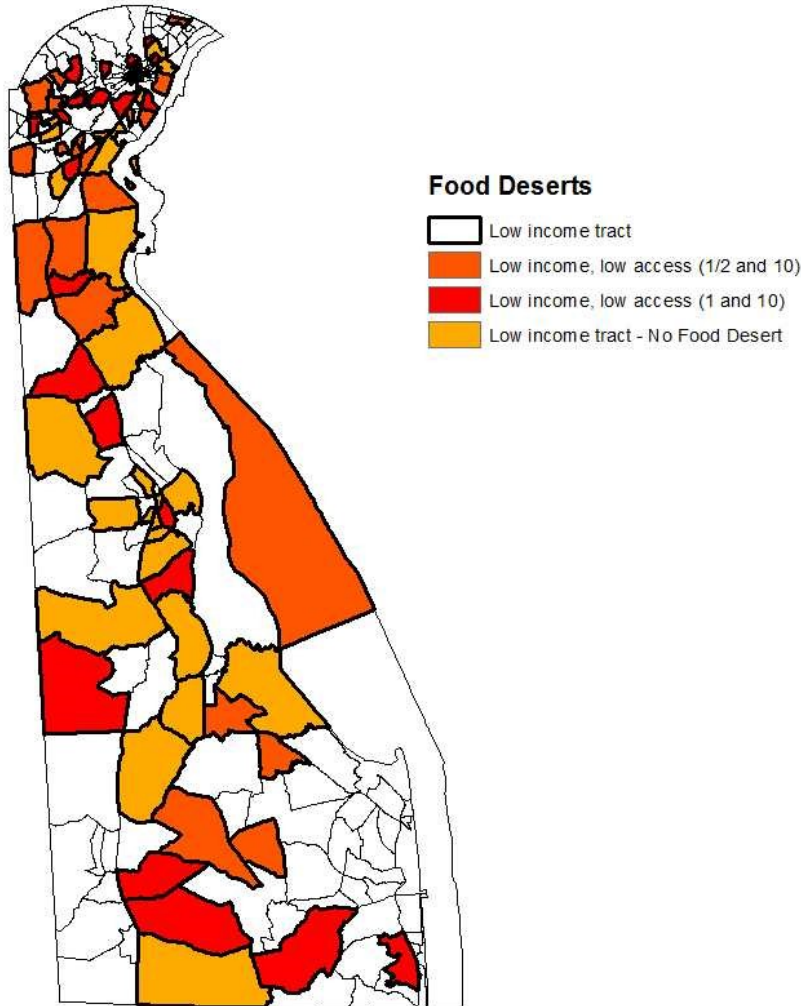


Figure 3 shows that SNAP recipients are geographically distributed across the state, with higher concentrations in the cities of Wilmington and Dover, as well as some rural Sussex County communities (Data source: Decennial Census & American Community Survey 2012-2016; U.S. Census Bureau 2015).

Figure 3: Delaware SNAP Recipients by Percentage (2012-2016)

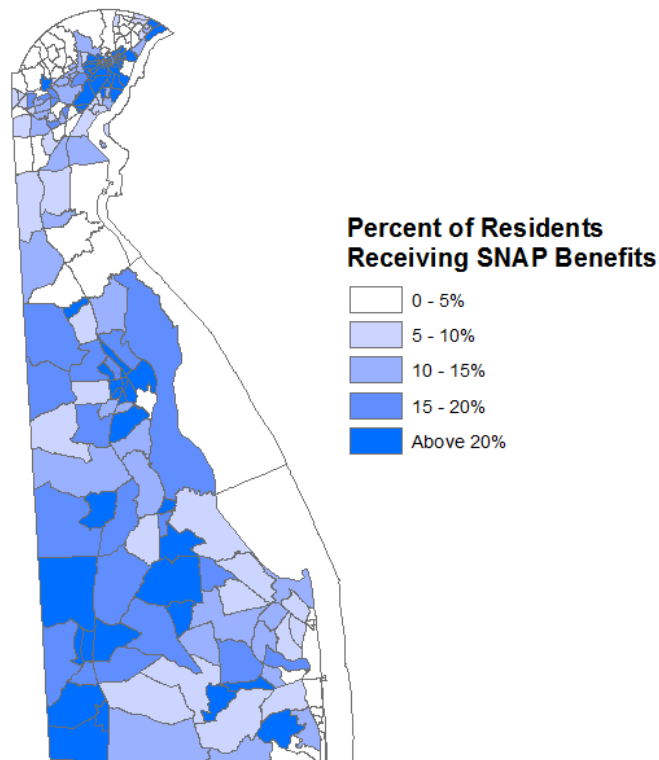


Figure 4 shows that areas where most SNAP recipients reside, there is an overlap with food deserts. The most challenging areas are those represented by red areas with a large green dot, as these represent areas with very high numbers of SNAP recipients who live in areas considered to be food deserts and therefore likely face barriers to accessing food (Decennial Census & American Community Survey 2012-2016; U.S. Census Bureau).

Figure 4: Percent of SNAP Recipients in Relation to Food Deserts in Delaware (2012-2016)

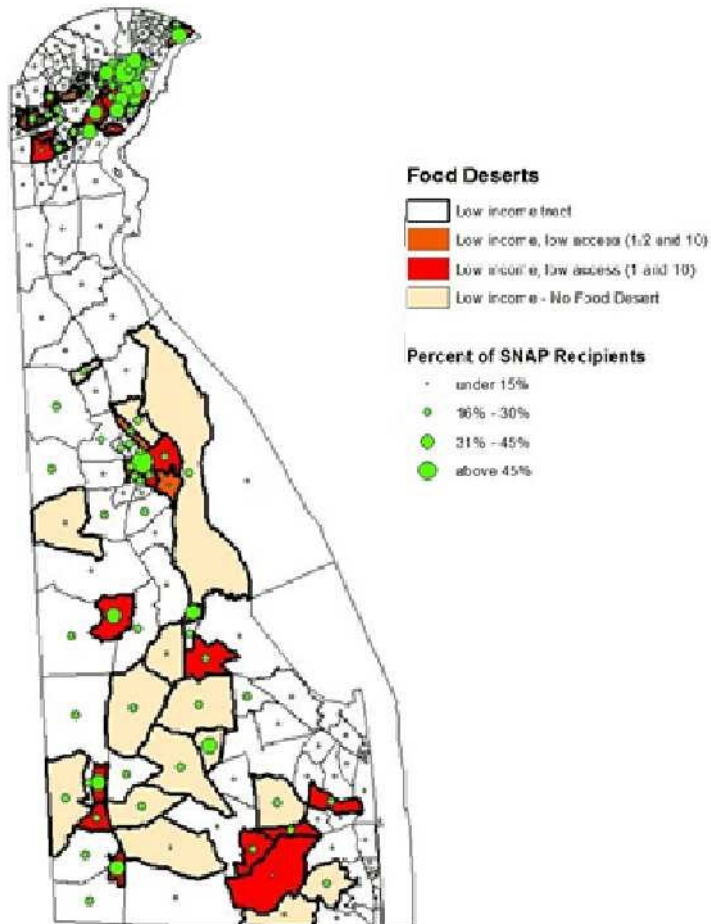
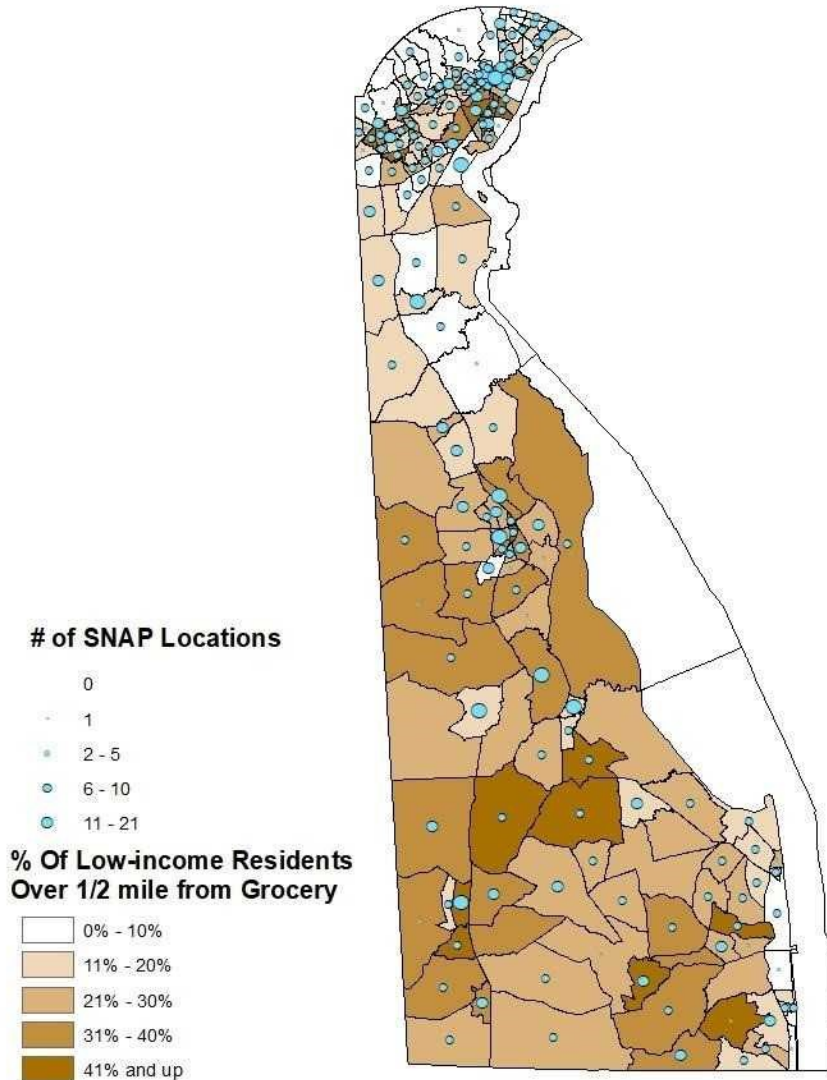


Figure 5 compares the number of SNAP locations in each census tract with the percentage of low-income residents of that tract who live over $\frac{1}{2}$ mile from the nearest grocery store. Rural residents and residents of the southeastern outskirts of Wilmington all have limited access to SNAP locations, at least when it comes to geographic proximity to their homes (USDA ERS Food Access Research Atlas).

Figure 5: SNAP Location Density & Low-Income Residents Living Over $\frac{1}{2}$ Mile from a Grocery Store (2016)



Discussion

Prevalence of Overweight

Delaware's prevalence of overweight adults is similar to the national average (31.8% and 39.8%, respectively). Census-tract level analysis revealed smaller communities with high prevalence of overweight adults in coastal Sussex County and New Castle County, around Wilmington and Dover in particular. Lifestyle behaviors may play a part in the prevalence of overweight adults. Along with diet and other factors, personal behaviors such as limited physical activity can

hinder individual's ability to maintain or obtain a healthy body weight.¹⁶ The Delaware Behavioral Risk Factor Surveillance Survey (BRFSS) found that 35.4% of Delawareans consume fruit less than one time per day, and 17.2% consume vegetables less than one time per day. Thirty one percent of Delawareans reported not participating in physical activities in the last month.¹⁷

Aside from these lifestyle behaviors, individuals residing in neighborhoods with limited access to healthy food, or with more availability to food options such as processed or fast foods with lower nutritional value are at risk for overweight and obesity.³ Pan et al. found that 35.1% of food-insecure adults are overweight, compared to 25.2% of food-secure adults.¹⁸ Food-insecure individuals were at risk for poorer health and often came from communities with less access to SNAP retail locations. Our maps indicate a similar picture, as census tracts defined as food deserts also had high prevalence rates of overweight adults.

Food Insecurity Rates at the County Level

Our analyses showed that Kent County experiences higher estimated rates of food insecurity compared to the national average (13.0% vs. 11.8%, respectively).¹³ According to a survey conducted for the Delaware Plan 4 Health project, Kent County residents experience several disparities related to food insecurity. Non-Hispanic blacks were more likely than non-Hispanic whites to report food insecurity, as were WIC/SNAP recipients compared to non-recipients. Respondents who reported food insecurity, household income <\$15,000, or WIC/SNAP participation were more likely to be morbidly obese. Most Kent County residents travel at least three miles to get to their food stores, and WIC/SNAP participants were more likely than non-participants to rely on public transportation when food shopping.¹⁹ These issues illustrate the necessity of removing barriers to healthy food access in order to make food security possible for all Kent County households.

Comparing Food Insecurity and SNAP Locations Within Census Tracts

We found several census tracts south of Wilmington that appeared to be underserved by current SNAP locations. Given that many of these census tracts were considered food deserts and had 20% or more of the population receiving SNAP benefits,¹⁴ it appears that these would be logical areas to add new SNAP retail locations. While barriers to access are more complicated than straight-line distance to a grocery store, the co-occurrence of food deserts and SNAP participation in this region underscores the need for SNAP retailers that provide healthy food options.

A more complicated issue is approaching areas in western and southern Delaware that are considered food deserts. In densely populated areas, it is easy to identify areas in need of additional food sources. In rural census tracts with relatively small populations, there may be very high percentages of residents experiencing food insecurity, but the actual number of these residents might still be fairly low, meaning that additional SNAP locations would not reach a large number of families and individuals in need. In these regions it may be more efficient to offer transportation assistance to existing SNAP locations, due to the feasibility of opening additional food outlets.

Food Deserts, Poverty and SNAP

Of Delaware's 197 census tracts, there are 15, primarily in the northeastern part of the state, in which 45% or more of the population receives SNAP benefits. Figure 5 shows these areas tend to overlap with USDA-defined food deserts. This mirrors nationwide trends in which 92% of SNAP benefits go to households with incomes below the poverty line, and 56% of benefits go to households below half the poverty line, enabling these households to afford more healthy foods.⁸

Market-driven mechanisms may contribute to the lack of quality food options in high-need communities. The city of Wilmington faced two grocery store closures in 2015 alone, due in part to bankruptcy of grocery store chains and increased competition from dollar stores and superstores such as Target and Walmart.²⁰ It is worth noting that the locally owned Kenny Family ShopRites recently opened a store in Wilmington's developing Christina Crossing Shopping Center, and participated in a partnership with Goodwill to promote community employment.²⁰

Study Implications

It is perplexing to see the number of food deserts in a state where 2,500 farms account for 39 percent of all land. Delaware's annual value in agricultural sales is over one billion dollars, and the poultry livestock revenue is a three billion-dollar industry.⁹ This places Delaware in a unique position to develop alternative methods of supplying healthy food options. For example, the state could collaborate with farmers to sell locally-grown poultry and vegetables through mobile markets.

The findings of this study suggest that expansion of SNAP retail locations may help improve access to healthy food, reduce food insecurity, and in turn reduce rates of overweight and obesity. This may also increase the number of low-income residents that live within ½ mile of the nearest grocery store, addressing one component of food deserts. Transportation vouchers may also help to ensure food access for SNAP recipients living in census tracts with zero or few grocery stores.

Next Steps for Research

This study raises issues worth future research. More information is needed to differentiate between barriers to food access in Delaware's urban and rural communities. Studies should also consider grocery store access from customers' workplaces, schools, or childcare centers, as access need not be defined solely by distance from residence.

Another valuable study could categorize SNAP retail locations by type. A typical chain grocery store can successfully provide healthy food to large populations and serve entire neighborhoods, whereas a corner store lacks the same selection of foods and serves a much smaller population. Given that our maps indicated areas with few SNAP locations but sufficient levels of access and food security, it is possible that these areas are served by SNAP locations more capable of serving a large population. A study categorizing these retailers could create a more complete portrait of areas served (or underserved) by SNAP retailers.

Strengths & Limitations

This study was strengthened by the use of high-quality, publicly available data from federal agencies including the CDC, U.S. Census Bureau, and USDA ERS. The study's variables of

food insecurity and food deserts are well-defined and covered in-depth in academic literature. This allowed us to place our findings into context and identify explanations for visual trends in the maps.

However, the study is limited in that it only described broad geographic associations between food insecurity, SNAP participation, food deserts and obesity. Another limitation is the assumption that Delaware SNAP recipients would be limited to food shopping in the state, as some may choose to use their benefits in the bordering states of Maryland and Pennsylvania. Although this study clearly demonstrates the coexistence of food insecurity and food deserts in Delaware, we cannot describe the nutritional value of food purchased through SNAP and its potential relationship to rates of overweight and obesity. Numerous factors – such as poverty, employment, and education – confound the relationship between food access and health outcomes and deserve further study.

Conclusion

Our study identified two areas in Delaware in need of support to increase healthy food access. The first is Wilmington and its southeastern suburbs, where high concentrations of low-income residents and SNAP recipients lack a sufficient number of grocery stores. This suggests a need for more SNAP-accepting retailers. The second area of need is in south-central Delaware, where many rural residents who receive SNAP cannot reach a SNAP retail store without driving over 20 miles. Efforts to increase SNAP retail access through mobile units or transportation assistance may be necessary here. Prioritization of food access in these areas, combined with interventions to address economic and individual factors influencing obesity, may provide a viable approach to improve Delawareans' consumption of healthy, affordable foods.

The authors declare no conflict of interest.

References

1. Centers for Disease Control and Prevention. (2016). Defining adult overweight and obesity. Retrieved from <https://www.cdc.gov/obesity/adult/defining.html>
2. Kapetanakis, V. Brown, McPherson, K., Webber, L., Rtveladze, K., & Marsh, T. (2012). OP26 by-state comparison of obesity trends in the adult population of the United States of America. *Diet and Obesity*. Retrieved from http://jech.bmj.com.proxy1.lib.tju.edu/content/66/Suppl_1/A10.3
3. The State of Obesity. (2018). State briefs. Retrieved from <https://stateofobesity.org/states/de/>
4. Berclaw, S. (2017). Food Insecurity in Delaware. University of Delaware. Retrieved June 5, 2018 from: <http://extension.udel.edu/blog/food-insecurity-in-delaware/>
5. Pruitt, S., Leonard, T., Xuan, L., Amory, R., Higashi, R., Nguyen, O., . . . Swales, S. (2016, October 13). Who is food insecure? Implications for targeted recruitment and outreach, National Health and Nutrition Examination Survey, 2005–2010. Retrieved June 6, 2018, from https://www.cdc.gov/pcd/issues/2016/16_0103.htm
6. Feeding America. (2018). Hunger in Delaware. Retrieved from <http://www.feedingamerica.org/hunger-in-america/delaware/>

7. Kearney, M. S., & Harris, B. H. (2013). Hunger and the important role of SNAP as part of the American safety net. Retrieved from <https://www.brookings.edu/blog/up-front/2013/11/22/hunger-and-the-important-role-of-snap-as-part-of-the-american-safety-net/>
8. Center on Budget and Policy Priorities. (2018). Delaware: food supplement program. Retrieved from https://www.cbpp.org/sites/default/files/atoms/files/snap_factsheet_delaware.pdf
9. United States Department of Agriculture. (2015). Food access research atlas. Retrieved from: <http://www.ers.usda.gov/data-products/food-access-research-atlas/download-the-data.aspx>
10. United States Department of Agriculture. (2017). Food & Nutrition Assistance. Retrieved from <https://www.ers.usda.gov/topics/food-nutrition-assistance/food-security-in-the-us/>
11. Jacobson, E., O’Hanlon, J., & Clark, A. (2011). Access to healthy foods in the built environment. Institute for Public Administration. Retrieved from www.ipa.udel.edu/publications/HealthPolicyIssueBrief3.pdf
12. United States Census Bureau. (2018). TIGER Products. From Geography: <https://www.census.gov/geo/maps-data/data/tiger.html>
13. Feeding America. (2016). Map the Meal Gap. Retrieved from Feeding America: <http://map.feedingamerica.org/>
14. United States Census. (2016). Census’ small area income and poverty estimates. Retrieved from U.S. Census: <https://www.census.gov/programs-surveys/saipe/data.html>
15. United States Department of Agriculture. (2018). SNAP retail locations. Retrieved from USDA Food and Nutrition Service: <http://www.fns.usda.gov/snap/retailerlocator>
16. Hruby, A., & Hu, F. B. (2015, July). The epidemiology of obesity: A big picture. *Pharmacoeconomics*, 33(7), 673–689. [PubMed https://doi.org/10.1007/s40273-014-0243-x](https://doi.org/10.1007/s40273-014-0243-x)
17. Centers for Disease Control and Prevention. (2017). BRFSS prevalence & trends data. Retrieved from <https://www.cdc.gov/brfss/brfssprevalence/>
18. Pan, L., Sherry, B., Njai, R., & Blanck, H. M. (2012, September). Food insecurity is associated with obesity among US adults in 12 states. *Journal of the Academy of Nutrition and Dietetics*, 112(9), 1403–1409. [PubMed https://doi.org/10.1016/j.jand.2012.06.011](https://doi.org/10.1016/j.jand.2012.06.011)
19. Delaware Plan 4 Health. (2016). Kent County resident survey summary of results. Retrieved from <http://deplan4health.org/wordpress/wp-content/uploads/2016/12/Plan4Health-Survey-Report-2016-012-7-updated.pdf>
20. Parra, E. (2015). Delaware’s food deserts grow. The News Journal. Retrieved from <https://www.delawareonline.com/story/news/local/2015/09/13/delawares-food-deserts-grow/72213132/>